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OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400
Facsimile: (703) 836-2787

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BOX PATENT APPLICATION

NONPROVISIONAL APPLICATION TRANSMITTAL
RULE §1.53(b)

Director of the U.S. Patent and Trademark Office
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Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the nonprovisional patent application

For (Title): A BLOWER AND A MANUFACTURING METHOD OF THE SAMEBy (Inventors): Kaoru MATSUMOTO

- ☒ Formal drawings (Figs. 1-4; 3 sheets) are attached.
☒ A Declaration and Power of Attorney is filed herewith.
☒ An assignment of the invention to Minebea Co., Ltd. is filed herewith.
☐ An Information Disclosure Statement is filed herewith.
☐ A statement to establish small entity status under 37 C.F.R. §§1.9 and 1.27 is filed herewith.
☐ A Preliminary Amendment is filed herewith.
☐ Please amend the specification by inserting before the first line the sentence --This nonprovisional application claims the benefit of U.S. Provisional Application No. _____, filed _____.--
☒ Priority of foreign application No. 2000-053645 filed February 29, 2000 in Japan is claimed (35 U.S.C. §119).
☐ A certified copy of the above corresponding foreign application(s) is filed herewith.
☒ The filing fee is calculated below:

CLAIMS IN THE APPLICATION AFTER ENTRY OF
ANY PRELIMINARY AMENDMENT NOTED ABOVE

FOR:	NO. FILED	NO. EXTRA
BASIC FEE		
TOTAL CLAIMS	8 - 20	= 0
INDEP CLAIMS	2 - 3	= 0
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS PRESENTED		

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SMALL ENTITY

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x 9 =	\$
x 39 =	\$
+130 =	\$
TOTAL	\$

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x 18	\$
x 78	\$
+260	\$
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- ☒ Check No. 110668 in the amount of \$690 to cover the filing fee is attached. Except as otherwise noted herein, the Director is hereby authorized to charge any other fees that may be required to complete this filing, or to credit any overpayment, to Deposit Account No. 15-0461. Two duplicate copies of this sheet are attached.
☐ This application is entitled to small entity status. DO NOT charge large entity fees to our Deposit Account.

Respectfully submitted,

James A. Oliff
Registration No. 27,875

Joel S. Armstrong
Registration No. 36,430

JAO:JSA/emb

Inventor Information

Inventor One Given Name:: Kaoru
Family Name:: MATSUMOTO
Name Suffix::
City of Residence:: Kitasaku-gun
State or Prov. of Residence::
Country of Residence:: Japan
Inventor Two Given Name::
Family Name::
Name Suffix::
City of Residence::
State or Prov. of Residence::
Country of Residence::
Inventor Three Given Name::
Family Name::
Name Suffix::
City of Residence::
State or Prov. of Residence::
Country of Residence::
Inventor Four Given Name::
Family Name::
Name Suffix::
City of Residence::
State or Prov. of Residence::
Country of Residence::
Inventor Five Given Name ::
Family Name::
Name Suffix::
City of Residence::
State or Prov. of Residence::
Country of Residence::

Correspondence Information

Name Line One:: Oliff & Berridge PLC
Address Line One:: P.O. Box 19928
City:: Alexandria
State or Province:: VA
Postal or Zip Code:: 22320
Telephone:: (703) 836-6400
Fax:: (703) 836-2787
Electronic Mail:: commcenter@oliff.com

Application Information

Title Line One:: A BLOWER AND A MANUFACTURING METHOD
Title Line Two:: OF THE SAME
Title Line Three::
Title Line Four::

A BLOWER AND A MANUFACTURING METHOD OF THE SAME
Background of the invention

Field of the invention

The present invention relates to a blower and the manufacturing method of the same, which is used for a variety of office automation appliances (hereinafter referred to as "OA appliances").

Conventional art

Conventionally, in the most OA appliances, many electronic parts are accommodated in a casing, so, the electronic parts are threatened to be damaged due to a heat generated from the electronic parts and accumulated in the casing. And, in general, a ventilation hole is provided in a side wall of the casing and where a blower is installed to discharge the heat accumulated in the casing outside in order to avoid the above problems.

As an example of such blower, there is one such as shown in Fig. 4.

In Fig. 4, a casing 1 forms a cylindrical venturi portion 2 (casing 1). Inside the venturi portion 2, there is an inclined surface at a small inclination angle to form an annular projection (throttle portion).

A motor base 3 is molded integrally at a central portion of one end side (lower in Fig. 4) of the venturi portion 2 (casing 1).

The motor base 3 is formed in general from an annular base body 4, a cylindrical bearing box portion 5 provided in hanging from a hole forming portion of the base body 4 and a base flange 6 formed in bending in the same direction with the bearing box portion 5 on a periphery edge portion of the base body 4.

An annular floor 7 (hereinafter referred to as "central floor") is formed inside the bearing box portion 5 and partitions the bearing box portion into two chambers (hereinafter referred to as "the first chamber at upper in Fig. 4 and the second chamber at lower in Fig. 4": signs are omitted).

Bearings (hereinafter referred to suitably as the first, the second bearings 10, 11) are coupled with the bearing box portion 5 in such a manner as they are disposed respectively in the first and second

chambers, which support rotatably a shaft (rotor shaft) 12 inserted through a hole (sign is omitted) of the central floor 7 at two positions.

On one end (Fig. 4, lower) of the rotor shaft 12 a stopping ring 13 for preventing the shaft from being pulled out is installed. On the other end (Fig. 4, upper) of the rotor shaft 12, knurling 14 are engraved. A cup-shaped yoke (motor yoke) 15 is held by insert-molding at the portion provided with knurling 14. An impeller 16 is coupled with the motor yoke 15. An impeller 16 is formed cylindrical and comprises an impeller body 17 to be coupled with the motor yoke 15 and a plurality of blades 18 held on the periphery of the impeller body 17.

And, a ring-shaped magnet 19 is fixed on an inner circumferential side of the motor yoke 15, with an adhesive. A stator assembly 20 is fixed outside of the bearing box portion 5. The stator assembly 20 is in general formed of a stator core 21, a coil 22 wound around the stator core 21 and an insulating body 23 interposed between the stator 21 and the coil 22. A printed circuit board (hereinafter referred to as "PC board") 24 is disposed at one end side (Fig. 4, lower) of the stator assembly 20.

The PC board 24 comprises an electronic circuit (not shown) connected to the coil 22 through a terminal 25 provided on the coil 22. This electronic circuit is adapted to control for rotation of the magnet 19 that is the impeller 16 for rotation by carrying out a current control to the coil 22 due to an electro-magnetic force between the coil 22 and the magnet 19 [that is, a rotor consisting of the magnet 19, the motor yoke 15 and the stator assembly 20 (not shown) function as a brushless motor]. Further, the terminal 25 and the PC board 24 are connected by soldering.

In Fig. 4, 26 designates a lead to supply an electric power to the coil 22 through an electronic circuit.

The blower structure mentioned above is adapted to fix the PC board 24 to the stator assembly 20 by soldering the terminal 25 of the coil 22 consisting of the stator assembly 20 to the electronic circuit of PC board 24.

And the substance 30 (for convenience' sake, called as a board fixing stator assembly) obtained by fixing PC board 24 to the stator assembly 20 is applied with a resin molding 31 by casting type and the obtained one (hereinafter for convenience' sake, referred to as a resin molded board fixed stator assembly) 32 is adapted to be adhered and fixed to the bearing box portion 5.

In the blower structured above, a blow in an axial direction is generated by the rotation of the blades 18 of the impeller 16 in the venturi portion 2, and the inside of the casing of the OA appliances is cooled by this blow and a damage of electronic parts installed in the OA appliances due to the heat generated is prevented.

Now, it has been desired to increase the productivity of a blower and to lower the manufacturing cost. However, in the above mentioned prior art, the board fixing stator assembly 30 is prepared by applying a resin molding with a casting type is applied, which includes many processes such as a resin casting process, a vacuum treatment process for evacuating air and a heat treatment process for accelerating hardening, and thereby, the productivity has been lowered and to that extent a higher manufacturing cost is invited.

For reference, it is considered to use an injection molding as a means enabling to reduce the number of process comparing with the casting type. However, when employing the injection molding in place of the casting type for the board fixing stator assembly 30, a resin (resin molding 31) thickness of the resin between the stator assembly 20 and the PC board 24 varies enormously, thereby, the PC board 24 is apt to be deformed, damaged and threatened to generate a wire cutting of the electronic circuit due to a sink of the resin (resin molding 31). So that, even if the injection molding is employed, actually the above requirement (for productivity increasing and cost lowering) has not been appropriately responded.

The present invention has been made in the light of the above circumstance to provide a blower which enables to realize an increasing of productivity and lowering of the manufacturing cost without inviting a deformation and a damage, and a manufacturing method thereof.

the base body 4, a base flange 6 formed by bending in the same direction of the bearing box 5 at the edge of the periphery of the base body 4.

Inside the bearing box 5, an annular floor (called as a center floor) 7 is formed, the inside of the bearing box 5 is defined into two chambers (a chamber at upper in Fig. 4, is called the first chamber, a chamber at lower is the second chamber) (sign is omitted). In the bearing box 5, the bearings (hereinafter, for convenience, referred to as the first and second bearing 10 and 11) are coupled in such a manner as those are disposed in the first chamber and the second chamber respectively, and support rotatably a shaft (a rotor) 12 inserted through the hole (not shown) of the central floor 7 at two portions.

A tip end side portion 5b of the bearing box 5 is set to be thinner in a wall thickness comparing with a proximal side portion 5a located under the central floor 7 of the bearing box 5, thereby a stepped portion (not shown) is formed on the periphery side of the bearing box 5.

At one end (lower in Fig. 1) of the rotor shaft 12, a stopper ring 13 for preventing the rotor shaft from being pulled out is provided.

At the other end (upper in Fig. 1) of the rotor 12, a knurling 14 is engraved. At the portion of the rotor 12 to be applied with a knurling 14, a cup-shaped yoke (motor yoke) 15 is held by being insert-molded. To the motor yoke 15 an impeller 16 is inserted. The impeller 16 is configured cylindrical and comprises an impeller body 17 to couple with the yoke 15 and a plurality pieces of blades 18.

On an inner circumferential side of the motor yoke 15, a ring-shaped magnet 19 is fixed by adhering.

On an outer side of the bearing box 5, the stator assembly 20 is fixed by adhering. The stator assembly 20 is formed in general with a stator core 21, a coil 22 wound around the stator core 21 and an insulator 23 interposed between the stator core 21 and the coil 22. At one end (lower in Fig. 1) of the stator assembly 20, a PC board 24 is disposed.

The PC board 24 comprises an electronic circuit (not shown)

is adapted to be coupled with the periphery of the bearing box 5.

In the above mentioned conventional art (Fig. 4), although a blower has been manufactured by using the casting type including a lot of processes such as a resin pouring, a vacuum treatment for air evacuation and a heat treatment for accelerating the resin to be hardened, in the present embodiment, a blower is manufactured by using an injection molding process having a small number of processes comparing with the casting type, thereby the number of production process can be reduced to improve the productivity. In addition, together with the improvement of the productivity a cost lowering of the blower can be realized.

Further, in the above conventional art (Fig. 4) in which an injection molding is used to the board fixing stator assembly 30, the thickness of the resin (resin molding 31) between the stator assembly 20 and the PC board 24 varies greatly, so that, there is threatened to generate a breakage by a deformation of the PC board 24 due to a sink of the resin (resin molding 31) and a snapping of a lead of the electronic circuit.

On the other hand in the embodiment of the present invention, the PC board 24 is disposed at one end side (Fig. 1 lower) of the stator assembly 34 finished with the first injection molding by abutting thereto, and the stator assembly 41 finished with the second injection molding is obtained by applying molding to the board holding stator assembly 39 formed by soldering the PC board 24 to the terminal 25.

And, as to the molding problem being caused between the stator assembly 20 and the PC board 24 in the conventional art, the molding has been already finished as a part of the resin covering body 33 in the stator assembly 41 finished with the second injection molding to be obtained a the process prior to the process where an injection molding is applied to the board holding stator assembly 39. Thereby, the deformation and breakage of the PC board 24, which can be generated due to the great variation of the thickness of the resin (resin molding 31) between the stator assembly 20 and the PC board 24 in the conventional technique (Fig. 4) using an injection

molding, and the snapping of the wire of the electronic circuit provided on the PC board 24 are not generated.

And, the electronic parts are happened to be influenced by the sink of the injection molded resin to be used in the electronic circuit of the PC board 24, because there are various shapes of the electronic parts. In that case, comparatively soft kind of resin is applied to the PC board 24, or it is impregnated in advance, and subsequently due to the application of the injection molding the breakage of the electronic parts of the electronic circuit and the snapping of the wire of the electronic circuit can be avoided.

In the above embodiment, although the case where an injection molding is applied to the PC board 24 on the board holding stator assembly 39 is exemplified, it is not limited to this, the casting type of molding may be applied in place of injection molding to the PC board 24 in the board holding stator assembly 39.

According to any one of the first to fourth aspects of the present invention, since the extraction terminal is projected outward, the stator is applied by the injection molding and the injection molding in which the number of the process of which can become smaller than the casting molding is employed, the productivity of the blower is improved and also intended to lower the production cost.

Further, since the PC board is connected electrically to the extraction terminal after the extraction terminal is projected outward and the stator is injection-molded with a resin, whole of the PC board connected with the above extraction terminal is molded with a resin, the great generation of variation of the thickness of the resin existing between the stator and the PC board, which have been apt to occur in the conventional art in which the injection molding has been used is not invited, in its turn, a possible generation of the deformation and breakage of the PC board, and the snapping of the wire of the electronic circuit mounted on the PC board are not generated.

According to any one of the aspects from fifth to eighth, the improvement of the productivity of the blower and accordingly the cost lowering of the blower can be intended, because the stator is

molded with a resin while the extraction terminal being projected outward by employing the injection molding which needs process smaller in number comparing with the casing molding.

Further, the great variation in resin thickness between the stator and the PC board which has been apt to be generated in the conventional art using an injection molding are not invited , because whole of the PC board connected electrically to the extraction terminal which is in advance projected outward while the stator is injection molded. Thereby, the deformation and breakage of the PC board and the snapping of the wire of the electronic circuit of the PC board which may be generated due to variation are not generated.

What is claimed is:

1. A blower comprising a bearing box for housing a bearing formed in the center portion of a cylindrical casing, a rotor held on a shaft supported rotatably on the bearing, a stator consisting of a stator core and a coil held on the periphery of the bearing box, a ring-shaped magnet spaced from the stator at a given gap and a PC board connected to an extraction terminal of the coil and provided with an electronic circuit for controlling a current to the coil, wherein the extraction terminal is projected outward, the extraction terminal is connected electrically to the PC board injection-molded with the stator with a resin and the whole of the PC board is injection molded with a resin.

2. A blower according to Claim 1, wherein the resin molding of the whole of the PC board is carried out by the injection molding.

3. A blower according to Claim 2, wherein the whole of the PC board is in advance coated with a resin or impregnated with a resin and is injection molded with a resin.

4. A blower according to Claim 1, wherein the molding with a resin to the whole of the PC board is carried out by a casting molding.

5. A manufacturing method of a blower in which, a bearing box for housing a bearing in the center portion of a cylindrical casing is formed, a rotor is held on a shaft supported rotatably on the bearing, a stator consisting of a stator core and a coil held on the periphery of the bearing box, a ring-shaped magnet is provided on the rotor spaced from the stator at a given gap a PC board having an electronic circuit for controlling the current to the coil, wherein the manufacturing method comprises a step of projecting out the extraction terminal, a step of injection-molding a stator with a resin, a step of connecting electrically the extraction terminal to the PC board injection-molded with the stator with a resin and a step of molding the whole of the PC board with a resin.

6. A manufacturing method according to Claim 5, wherein the molding with a resin of the whole of the PC board is carried out by the injection molding.

7. A manufacturing method according to Claim 6, wherein, after a resin is coated on the whole of the PC board or the PC board is impregnated with a resin, the molding of the whole of the PC board is carried out by the injection molding.

8. A manufacturing method according to Claim 5, wherein the molding of the whole of the PC board is carried out by a casting molding.

Abstract of the disclosure

The terminal 25 is projected outward and the injection molding is applied to the stator assembly 20 to obtain the stator assembly 34 finished with the first injection molding, subsequently the board holding stator assembly 39 is obtained by soldering the PC board 24 to the terminal 25 and the PC board 24 is injection-molded. Since the injection molding is employed, the number of process of which is smaller than comparing with the casting molding, the improvement of the productivity and the manufacturing cost are intended. The variation of the thickness of the resin between the stator and the PC board being apt to be generated in the conventional art is not invited, in its turn, the deformation, breakage of the PC board and the snapping of wire of the electronic circuit which may be generated due to the variation are not generated.

Representative drawing: Fig. 1

FIG. 2

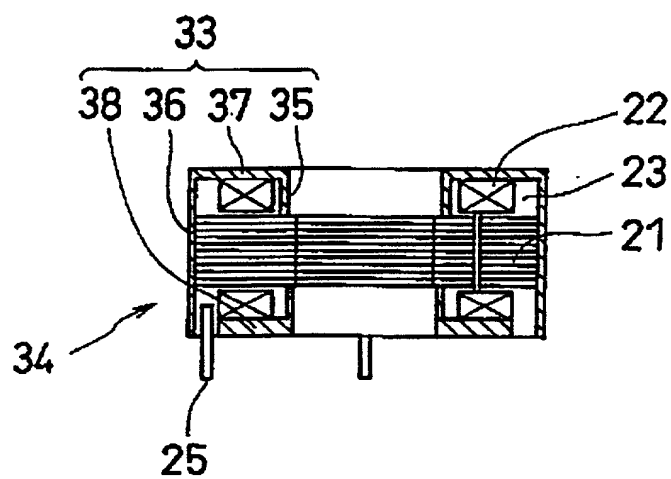
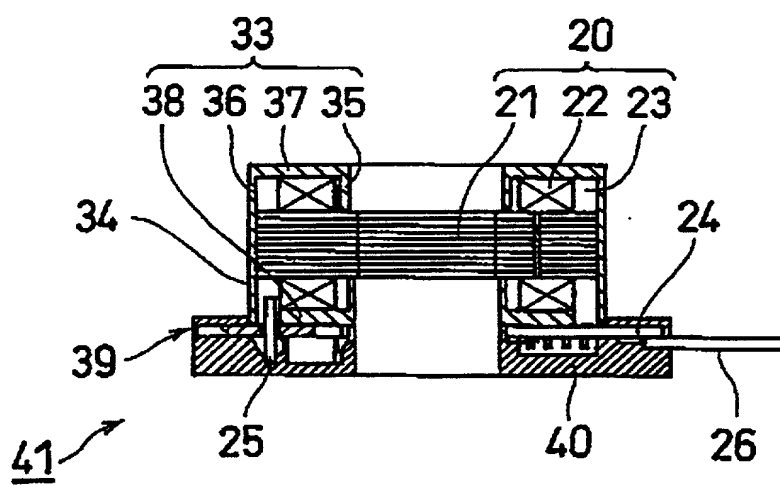
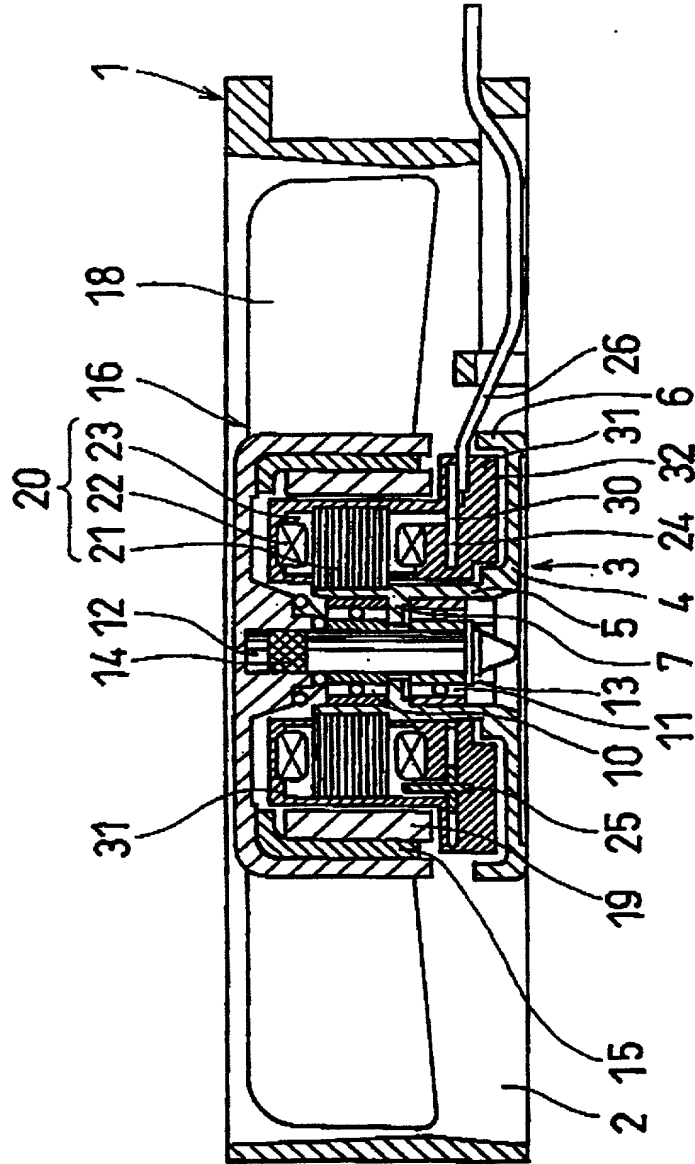


FIG. 3



F I G.4 (Prior Art)



APPLICATION FOR UNITED STATES PATENT DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A BLOWER AND A MANUFACTURING METHOD OF THE SAME

described and claimed in the specification:

Check one

*a. ☒ attached hereto.

b. ☐ filed on _____ as Application No. _____ and amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56. Under Title 35, U.S. Code §119, the priority benefits of the following foreign application(s) and/or United States provisional application(s) filed within one year prior to this application are hereby claimed:

Japanese Patent Application No. 2000-053645 filed on February 28, 2000

The following application(s) for patent or inventor's certificate on this invention were filed in countries foreign to the United States of America either (a) more than one year prior to this application, or (b) before the filing date of the above-named foreign priority application(s) and/or United States provisional application(s):

I hereby appoint the following as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent Office:

James A. Oliff, Reg.No.27,075; William P. Berridge, Reg.No.30,024; Kirk M. Hudson, Reg.No.27,562;

Thomas J. Pardini, Reg.No.30,411; and Edward P. Walker, Reg.No.31,450.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO OLIFF & BERRIDGE, P.O. BOX 19928, ALEXANDRIA, VIRGINIA, 22320, TELEPHONE (703) 826-6400.

I hereby declare that I have reviewed and understand the contents of this Declaration, and that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

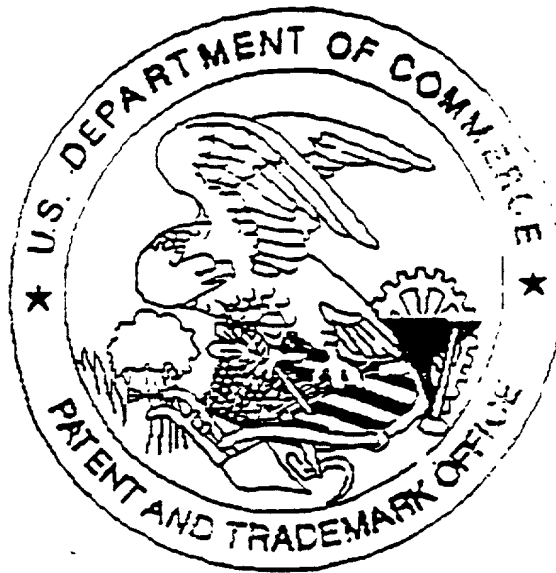
Typewritten Full Name of Sole or First Inventor	<u>Kaoru</u>	Middle Initial	<u>MATSUMOTO</u>
Given Name	<u>Kaoru</u>	Family Name	<u>Matsumoto</u>
**Inventor's Signature	<u>July</u>	26	2000
** Date of Signature	Month	Day	Year
Residence	<u>Kitasaku-gun</u>	<u>Nagano-ken</u>	<u>Japan</u>
City		State or Province	Country
Citizenship	<u>Japanese</u>		
Post Office Address	<u>c/o Minobee Co., Ltd. Karuizawa Manufacturing Unit</u>		
(Insert complete mailing address, including country)	<u>4108-73 Miyota, Miyota-machi, Kitasaku-gun, Nagano-ken, Japan</u>		

*This form may be executed only when attached to the specification (including claims) at the end thereof if Box a. is checked.

**Note to Inventor: Please sign name exactly as it appears above and insert actual date of signing.

IF THERE IS MORE THAN ONE INVENTOR USE PAGE 2 AND PLACE AN "X" HERE ☐

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Declaration

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